Docket No.: 124251
Serial No.: 10/604,740

REMARKS/ARGUMENTS

The present application was filed with 20 claims. Claims 2, 4 and 17-20 have been cancelled. Claims 1, 3, 5, 6, 9 and 11 have been amended. New claims 21 - 26 have been added. No new claim fees are believed required.

1. Amendments to the Claims

Claim 1 has been amended to introduce the limitations of claim 2 and 4. Claims 3, 5, 6 and 9 have been amended to change the claim dependency, and to provide antecedent basis. Claim 11 has been amended to require that the electrode be rigidly affixed to and electrically isolated from the discharge nozzle (support in page 6 para. 2 of the specification). Claims 2 and 4, and claims 17-20 drawn to an apparatus (Group II), have been cancelled. New claims 21-26 have been added, specifying preferred vacuum pressure limits (support at page 5, para. 3).

2. Restriction Requirement

Applicants confirm their provisional election of the invention of Group I, claims 1-16, and have cancelled Group II (claims 17-20).

3. Rejections under 35 USC 112

The Examiner states that Claims 1-16 lack enablement, as required by 35 USC 112, 1st paragraph. The Examiner seems to be alleging that the specification only enables a gas turbine component, whereas the claims recite "any substrate"; and that the specification would not enable a person of skill in the art to practice the invention as claimed without undue experimentation.

Applicants traverse the rejection.

First, the Examiner states that the specification must provide enablement for "any substrate". Applicants note that the claims are drawn to a method for removing a metal oxide from "an alloy surface of an article". Applicants contend that the scope of the claim is therefore more limited than "any substrate" as alleged by the Examiner.

The enablement requirement of 35 USC 112, 1st paragraph requires that the specification teach those in the art to make and use the invention without undue experimentation", and that some experimentation may be required does not fail the requirement. (*In re Vaeck*, 20 USPQ2d 1438 (Fed Cir 1991)). A determination that the amount of experimentation is "undue" requires the

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weighing of various factors, including the actually quantity of experimentation necessary, the amount of direction and guidance presented, the state of the art, the relative skill of those in the art, and others (*In re Wands*, 858 F.2d 731, 8 USPQ2d 1400 (Fed Cir 1988)).

Applicants contend that the Examiner has not addressed any of the required factors in determining whether the full scope of the invention as claimed is enabled, and therefore has failed to state a proper a *prima facie* rejection for lack of enablement. Applicants further note that the Examiner has cited several prior art references that generally teach the removal of metal oxides from metal or alloy substrates, which is an indication that the relative skill of those in the art is high. Applicants also contend that the invention as claimed provides a full and sufficient disclosure of the required steps and processing parameters of the method, and the suitability of a particular alloy can be readily determined without undue experimentation. The examiner mentions "literally thousands" of known substrates. This is not relevant, since the method is intended to be practiced on one "substrate" at a time. Applicants contend that the Examiner can not support an allegation that the amount of experimentation required to practice the invention on any one alloy article/surface would be undue experimentation.

The Examiner also states that Claims 1 and 15 are indefinite, in violation of by 35 USC 112, 2nd paragraph, as lacking a positive step of removing metal oxide. Applicants have amended Claim 1 to provide that the method "reduce" a metal oxide on an alloy surface of an article, thus rendering the rejection moot.

The Examiner also states that step 4 of claims 1 and 5 are indefinite because it is unclear what "time is sufficient" to reduce the metal oxide, or to what the oxide is reduced?

Applicants traverse the rejection. The "time sufficient" is the time required to expose the alloy surface having the metal oxide in order to reduce the metal oxide to the base alloy metal. The time that is sufficient can be determined by visual or elemental analysis of the alloy surface (see the examples). The phrase "time sufficient" in the claim is not indefinite *per se*, since the amount of detail required in the claims depends on the particular invention and the prior art, and is not to be viewed in the abstract but in conjunction with whether the specification is in compliance with 35 USC 112, first paragraph.

The Examiner also states that claim 3 is indefinite because it is unclear whether a metal oxide" is the same as the metal oxide recited in claim 1. Applicants have amended Claim 3 to specify "the" metal oxide referred to in Claim 1, thus rendering the rejection moot.

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The Examiner alleges that claim 4 is indefinite because it is unclear what is considered as a "sufficient vacuum". Applicants have amended Claim 4 to provide that the applied vacuum generates a meta-stable H_3^+ plasma, as taught in the specification, thus rendering the rejection moot. The specification teaches the general range of pressures sufficient to practice the claimed invention.

The Examiner also states that claims 4-5, 9-10 and 12 are indefinite because it is unclear what is meant by "meta-stable H3".

Applicants traverse the rejection. The term meta-stable is well known the persons skilled in this art. Patents are written to enable those skilled in the art to practice the invention. Nevertheless, to a person unfamiliar with the art, the metastable state is the particular excited state of a molecule of hydrogen (H_3^+) that has a longer lifetime than the ordinary excited states (H atomic) and that generally has a shorter lifetime than the lowest, often stable, energy state, H_2, called the ground state. A "metastable state" is considered a kind of temporary energy trap or a somewhat stable intermediate. Applicants understand that others have demonstrated that H_3^+ can survive as an entity in the metastable state for several seconds, whereas the typical lifetime of the lower-energy plasma species are in the order of nanoseconds.

The Examiner also considers that claim 12 is indefinite because it is unclear whether the percentage is weight or volume. Applicants have amended Claim 12 to specify "by volume".

The Examiner considers that claims 11-15 are indefinite because the structural relationship between the plasma source and the electrode is unclear. Claims 11 and 15 have been amended to provide an electrode that is "rigidly fixed to and electrically isolated from" the discharge nozzle of the plasma torch, thus rendering the rejection moot.

And finally, the Examiner states that claim 13 is indefinite because "the plasma generator" lacks positive antecedent basis. Applicant has amended claim 9, to which claim 13 depends, to depend to Claim 5, to establish the proper antecedent basis for "the plasma generator".

4. Rejections under 35 USC 103

The examiner rejects claims 1-2, 4-5, 7, 9 and 13 as being unpatentable over Dopper (US2001/0055653). The examiner state that Dopper teaches a method of removing oxide from a gas turbine blade 1 by directing a plasma 21 towards the substrate surface, as illustrated in Fig. 4 (paragraphs 11, 20, 55-57). Various portions of the disclosure of Dopper are referenced against various claims of the application. The rejection goes on to state that Dopper only teaches removing

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oxides, but that it would be obvious to remove metal oxides, and that the use of a plasma to remove metal oxides is notoriously well known.

Applicants respectfully traverse the rejection in view of the amended claims.

Dopper discloses a main, preferred embodiment wherein the cleaning plasma is generated using an inert gas, such as argon. As an alternative, a reactive gas, in particular hydrogen, can be used to form the plasma (end of paragraph 0020). Dopper teaches nothing about the pressure and other conditions necessary to form the meta-stable plasma, stating only that a "suitable sub-atmospheric pressure (vacuum) be established in the chamber.

As mentioned above, it is well known that hydrogen gas can form a variety of reactive plasma environments, at a wide variety of conditions of temperature, pressure and concentration. A typical reducing plasma formed from hydrogen gas comprises the reactive H (atomic). It is known to use amounts of hydrogen gas in a spray plasma in order to add heat to the system to help soften the sprayed powder. However, the extremely high heat transfer capability of a sustained plasma comprised of metastable H_3^+ would foil the spraying operation. Therefore, the typical plasma spraying operation needs to carefully set low and control the reverse bias voltage and the torch power level.

Thus, Dopper does not disclose generation of a meta-stable hydrogen species, or the specific conditions or range of conditions that could inherently generate the claimed H_3^+ active species, because there is no intention to form the same. Moreover, Applicant is not aware of any alloy cleaning prior art that discloses any apparatus or method for removing metal oxides from an alloy surface under conditions that form a meta-stable plasma of H_3^+ species, including the conditions of pressure and hydrogen concentration as disclosed in Applicants' specification. Applicants contend that Claim 1 as amended is both novel and unobvious over the Dopper.

The Examiner adds that Claim 3, directed to cracks in the substrate, is also rejected under 35 USC 103(a) over Dopper in view of Restall et al (4698130), which teaches that turbine blades incur damage by cracking, and the desire to remove oxide contaminants therefrom.

Applicant's contend that, as Claim 1 is novel and unobvious over the prior art, then claim 3 dependent thereto is also patentable, whereby the rejection in view of Restall et al is rendered moot.

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The examiner rejects claims 6, 8, 10-11 and 15-16 as being unpatentable over Dopper (US2001/0055653) in view of Gruner (4596718). Gruner is said to teach a vacuum plasma apparatus as illustrated in FIG. 1, used to clean turbine blades. The examiner concludes that it would have been obvious to a person of ordinary skill in the art to modify the method of Dopper to include the plasma torch of Gruner, to perform the same function of removing contaminants from the surface of turbine blades.

Applicants traverse the rejection.

Gruner teaches a coating apparatus for alloy parts. Gruner mentions a cleaning stage, but discloses only an argon gas supply (col. 6 lines 58-64).

The disclosure of Gruner makes one mention of hydrogen (H2) in column 7 at lines 32-35. The text states, "After the coating, evacuation takes place once more (curve section 78 [[of FIG. 7]]) in order to reduce the H2 concentration in the chamber if the operation has been carried out with the addition of H2 to the plasma gas. (emphasis added)" Applicants note that "the operation" referred to is the coating operation. It is well known in this art to use an amount of hydrogen in the coating plasma stream to provide heat to soften the coating particles for better adhesion. It is noted in column 5 lines 8-30 that two examples of spray powder conditions are provided, with example "a" showing a pressure of 40 mbar (about 30 torr). Therefore, Gruner teaches possible use of hydrogen gas in a powder spraying plasma stream wherein the pressure is about 30 torr, but makes no mention of the use of hydrogen in the cleaning plasma stream of argon gas.

Applicants therefore contend that the Examiner has failed to establish a prima facie case of obviousness, for failing to point out any disclosure or suggestion in either Dopper or Gruner for combining these two references. More importantly, the deficiencies in the teaching of Dopper are not provided in Gruner. In fact, Gruner makes no mention of the use of hydrogen gas in a cleaning plasma stream. Consequently, Applicants request reconsideration and withdrawal of the rejection.

Claim 12 is also rejected under 35 USC 103(a) over Dopper in view of Cohen (US 2001/0050265). Cohen is alleged to teach removal of metal oxides from substrate surfaces using conventional process gases comprising 5% or less hydrogen premixed with an inert gas (para. 12). The Examiner concludes that it would have been obvious to a person of ordinary skill to modify the method of Dopper to include hydrogen with a concentration of less than 5%, premixed with inert

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gas, as taught by Cohen, to generate a plasma used in the reduction of metal oxide from substrate surfaces.

Applicants traverse the rejection. First, Applicants believe that the Examiner has not stated a proper *prima facie* rejection of obviousness, since there is no motivation found in wither reference to be combined. Cohen teaches an etching chamber and method for removing metal oxides from integrated circuits, particularly copper and aluminum oxides, from a substrate. Dopper relates to cleaning and coating of alloy substrates. The two inventions are unrelated, and were classified and searched in completely different classes.

Nevertheless, even if the references were to be combined, Applicants believe that they would fail to teach the present invention. In para. 0024, Cohen states that "(d)uring processing, the chamber pressure is preferably maintained between about 20 mTorr and about 100 mTorr ...". The Examiner presumes that the teaching in Cohen of the pressure required for etching without sputtering, specifies the "suitable sub-atmospheric pressure" condition of Dopper. However, Applicants note that use of the processing conditions of Cohen to provide a pressure of between 20-100 mTorr would not provide a meta-stable H_3^+ plasma condition, as required by Applicants' claims. The Applicants therefore request reconsideration and withdrawal of the rejection.

Claim 14 is also rejected under 35 USC 103(a) over Dopper in view of Cohen (US 2001/0050265), and further in view of Venus (3851136). Venus teaches generating a plasma through a magnetic channel for purposes of accelerating the electrons used in the reduction of metal oxides. The examiner concludes that it would have been within the level of the skilled artisan to have modify the method of Dopper to include a magnetic field channel, as taught by Venus, for purposes of transmitting the flow of electrons within the plasma for use in the reduction of metal oxides.

Applicants traverse this rejection. First, Applicants believe that the Examiner again has not stated a proper *prima facie* rejection of obviousness, since there is no motivation found in wither reference to be combined. Venus relates to an apparatus and method for extracting metals are metal halides vapors, using a plasma disposed in a magnetic fields. Cohen teaches an etching chamber and method for removing metal oxides from integrated circuits, particularly copper and aluminum oxides, from a substrate. Dopper relates to cleaning and coating of alloy substrates. The two inventions are unrelated, and were classified and searched in completely different classes.

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Nevertheless, even if the references were to be combined, Applicants believe that they would fail to teach the present invention. Venus mentions in col. 5 lines 8-9 that the vacuum vessel is "filled with a desired gas (e.g., hydrogen, air or an inert gas)". Halogens, and particularly iodine, is the only exemplified and the clearly preferred gas. While hydrogen is mentioned, there is no other description or example of how the hydrogen gas might be used and under what conditions. The Applicants therefore request reconsideration and withdrawal of the rejection.

6. Other prior art made of record

The Examiner listed other art of record that was not relied upon, as pertinent to Applicant's disclosure, including Smith, Wulff, Meier, Eaton, Matarese, Aston, Rickerby, Li, Ikeda, Sanki and Kool.

7. Conclusion

Applicants believe that the present invention as claimed in the attached claim set, are clearly distinguished from the teachings of the prior art of record, and request for a prompt allowance of all claims.

Respectfully submitted,

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